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# THE INTERNATIONAL CONGRESS OF MATHEMATICIANS.

By GEORGE BRUCE HALSTED.

On the sixth of August at the Palais des Congrès in the Paris Exposition, was held the opening session of the second International Congress of Mathematicians. The president, Poincaré, is regarded as the greatest of living mathematicians. Among the vice presidents in attendance were Gordan, Lindeloef, Lindemann, Mittag-Leffler.

Representing Japan was Fujisawa ; Spain sent Zoel de Galdeano ; the United States, Miss Scott.

The president of the section of Arithmetic and Algebra was Hilbert ; of Geometry was Darboux, of Bibliography and History was Prince Roland Bonaparte. Among the most interesting personalities present may be mentioned Dickstein of Warsaw, Gutzmer of Jena, Hagen of Washington, Laisant of Paris, Langel of Golfe Juan, Lemoine of Paris, Delury of Toronto, Padoa of Rome, Shroeder of Carlsruhe, Sintsof of Yekaterinoslav, Stringham of Berkeley, Tannery of Paris, Vasiliev of Kazan. Whitehead of Cambridge.

Of the many important papers presented two may be selected for their general interest and the enthusiasm with which they were received.

These are : The Mathamatics of the Old Japanese School by Fujisawa, and The Problems of Mathematics by Hilbert.

Among other matters of extraordinary importance, Fujisawa showed his astonished audience that the Japanese had independently discovered the zero and by a mysterious coincidence used for it a circular symbol as did the Hindus and as do we. He showed that the Japanese had rectified the circle with an accuracy far exceeding Archimedes and only paralleled in our modern developments of pure mathematics. He showed that the Japanese had recognized $\sqrt{-1}$ the square root of minus one as a number, as a new unit, a neomon, and thus had reached the basis for the theory of the complex numbers.

This paper is epoch-making for the history of mathematics.

Hilbert's beautiful paper on the Problems of Mathematics shows that when a science progresses continuously we may from the problems which actually occupy it judge of its ulterior development. The existence of precise problems has a capital importance both for the progress of mathematics and for the work of each investigator.

Whence come the problems of mathematics ? It is experience that in each domain puts before us the primary problems (*e. g.* duplication of the cube, quadrature of the circle, etc.) In the later development of the science it is the mind which by logical reasonings (combination, generalization, specialization) creates itself problems new and fertile (*e. g.* problems of prime numbers). We say that a problem is solved when starting from a finite number of assumptions furnished by the problem itself we demonstrate the justness of the solution by a finite number of deductions. This mathematical rigor which we require does not necessitate complicated demonstrations; the most rigorous method is often the simplest and the easiest to comprehend.

The conceptions of arithmetic or those of analysis are not the only ones susceptible of rigorous treatment. Those of geometry and the physical sciences are equally so, provided that by means of a complete system of assumptions they are as well fixed as the conceptions of arithmetic.

When a problem presents serious difficulties, by what methods can we attack it?

First by *generalization*, in attacking the problem considered to a group of questions of the same order. (*E. g.* Introduction of ideal numbers into the theory of algebraic numbers; employment of complex paths in the theory of definite integrals).

Or else by *specialization*, in deepening the study of more simple analogous problems already solved.

The failure of attempts at the solution of a problem comes often from the problem being impossible to solve under the form given. Then we require a rigorous *demonstration of the impossibility*. (Parallel postulate, quadrature of the circle, algebraic solution of the equation of the fifth degree.)

We say that a conception exists from the mathematical point of view when the assumptions which define it are compatible, that is to say when a finite chain or system of logical deductions starting from these assumptions can never lead to a contradiction.

Mathematics in developing, far from losing its character of unique science, manifests it from day to day more clearly. Each real progress brings necessarily the discovery of methods more incisive and more simple, permitting to each geometer an access relatively facile to all the parts of our science.

The magnificent reception given by the President of France M. Loubet and his wife Madame Emilie Loubet in which the members of the Congress participated, was only surpassed in charm by the delightful entertainment given in our honor by Prince Roland Bonaparte.

## DEPARTMENTS.

### SOLUTIONS OF PROBLEMS.

### ARITHMETIC.

**130. Proposed by H. C. WHITAKER, M. E., Ph. D., Professor of Mathematics, Manual Training School, Philadelphia, Pa.**

Aow many balls 1 inch in diameter can be put in a cubical box 2 feet in the clear each way, putting in the maximum number?